Water Management Options Under Climate Change in the Swiss Alps

The touristic region of Sierre–Crans-Montana–Plaine Morte is located in one of the driest valleys of Switzerland. In the MontanAqua project, researchers analysed how climate change and socio-economic changes are likely to affect water availability and water use in the region by 2050, based on four development scenarios. The analyses generated five key governance messages for sustainable water management.

Bruno Schädler
Olivier Graefe
Emmanuel Reynard
Stephan Rist
Rolf Weingartner

Tracer experiment, Plaine Morte Glacier, Switzerland (F. Schneider)

The MontanAqua study [1] sought to assess and compare the possible impacts of climate change and socio-economic change in the region by the middle of this century, as well as to propose governance options for policymakers involved in Sierre–Crans-Montana–Plaine Morte, located in the dry inner-Alpine region of Valais, Switzerland.

Annual water resources (Figure 2.11), available mainly in the upper part of the area, are currently plentiful (140 million m^3). They are expected to decrease slightly in the future, in terms of average annual availability. However, dry periods are expected to increase and temporary water shortages are anticipated, especially in the second part of summer (August to September). The Plaine Morte Glacier, towering above the region at 3 000 m and boasting a volume of 0.8 km^3, is expected to disappear completely by the year 2080 [2]. The contributions of the Plaine Morte catchment will remain sizeable (about 18 million m^3), but water flows, especially due to snowmelt, are expected to reduce sharply in the second half of summer [3].

Current total use (Figure 2.12) for drinking water, tourism (e.g. snow production, a golf resort) and agriculture ranges from 10.5 million m^3 to 13.5 million m^3 annually, amounting to less than 10 percent of the total available annual flow. Hydro-

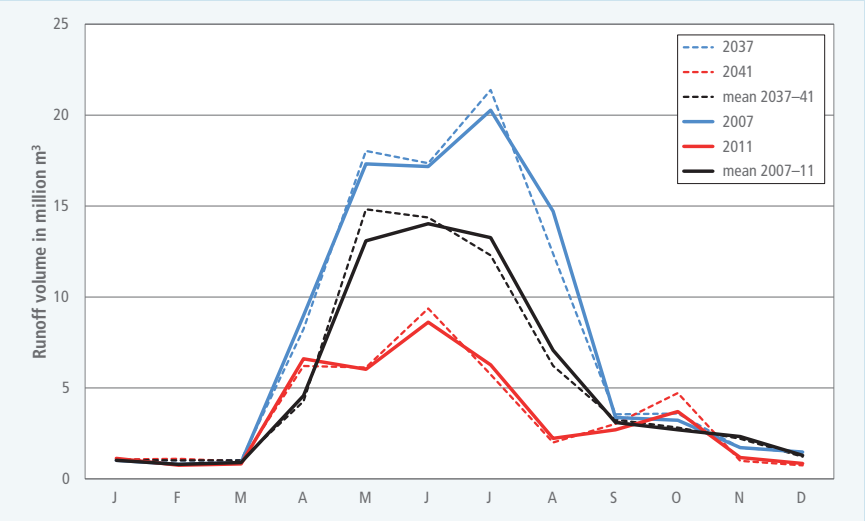

Figure 2.11. Annual water resource distribution for the "wet" year 2007, the "dry" year 2011 and mean annual values (2007–2011) in the eastern headwater region (Ertense to Tièche river) – the most important area in terms of water supplies to the Crans-Montana–Sierre region. The dotted lines represent projections for the near future (around 2040). Source: [1]

power production uses another 70–80 million m³ water per year [4]. Depending on four different socio-economic scenarios (see Table 2.2), future water needs are expected to remain stable or decline slightly on average. However, the pressure on water resources is expected to increase in the second half of the summer (August to September).

Current water-management approaches are characterized by supply management over demand management, by technical management over political management and by a high degree of legal complexity, compounded by a multitude of conventions and informal rights held by communes and other users [5]. The price of water generally remains low when compared with the national and international situations.

Residential areas are increasingly replacing vineyards in Crans-Montana, Switzerland (F. Schneider)

Aerial view of Crans-Montana resort, Switzerland (E. Rey)

Bisse de Lens, a traditional water channel near Crans-Montana, Switzerland (F. Schneider)

The region's current approach to water management may be described as moderately sustainable [6]. The different evolution scenarios analysed do not have the same impact in terms of sustainability. The "Growth" scenario is clearly characterized by a decrease in sustainability, while the other three scenarios would enhance sustainability (Table 2.2).

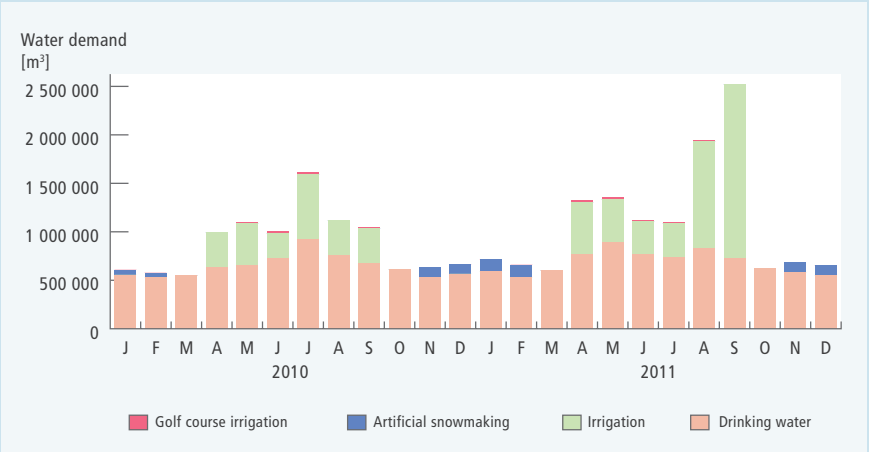

Figure 2.12. Water demand during a "normal" year (2010) and a "dry" year (2011), excluding hydropower production. Source: [1]

Final presentation of the research results to public authorities and stakeholders (HP. Liniger)

Scenario	Main characteristics	Water management
1 Growth	Mass tourism, lucrative activities and second homes are emphasized; agriculture is less important; the population increases.	Water issues are easily managed by technical measures (supply management).
2 Stabilization	Water and the landscape are considered the region's most important resources; the skiing area is reduced; agriculture remains a core economic activity; irrigation increases; there is slight population growth.	Water issues are managed by optimizing water consumption (demand management).
3 Moderation	Improving the quality of life of residents and visitors is emphasized; soft tourism; agriculture is very important, serving nature conservation and landscape maintenance goals; the population decreases.	Water issues are managed based on collaboration between the communes, benefitting the well-being of all the region's inhabitants.
4 Shared stakeholders strategy	A mixture of scenarios 2 and 3; slight population growth; improved water distribution systems and water management.	Water issues are managed based on collaboration between the communes on behalf of the well-being of all the region's inhabitants.

Table 2.2. Socio-economic scenarios of development in the Sierre–Crans-Montana region, Swiss Alps